



International Maize Conference
Gorontalo, Indonesia, November 21-23, 2012



**Proceedings of
International Seminar on
Agribusiness of Maize-Livestock
Integration**

Ministry of Agriculture
in collaboration with
Provincial Government of Gorontalo

Cetakan 2013

Hak Cipta Dilindungi Undang-Undang
@Badan Penelitian dan Pengembangan Pertanian, 2013

Katalog dalam Terbitan (KDT)

**BADAN PENELITIAN DAN PENGEMBANGAN
PERTANIAN**

Agribusiness of Maize-Livestock Integration/Jakarta: Badan
Penelitian dan Pengembangan Pertanian, 2013

xii, 301 hlm.: ill.; 24 cm

1. Maize 2. Agribusiness 3. Livestock

I. Judul

ISBN 978-979-1159-59-3

Badan Penelitian dan Pengembangan Pertanian
Jln. Ragunan 29, Pasarminggu, Jakarta 12540
Telp.: + 62 21 7806202, Faks.: 62 21 7800644

Prosiding Seminar Internasional ini dicetak dengan dana DIPA 2013
Pusat Penelitian dan Pengembangan Tanaman Pangan
Jalan Merdeka 147 Bogor 16111
Telp.: + 62 251 8334089, Faks.: +62 251 8312755
email: crifc1@indo.net.id

Foreword

The growing demand for biofuel which is mainly driven by the increasing oil prices has created more challenges as well as opportunities on agricultural development. For developing countries like Indonesia, the challenges are mostly related to food security since maize, as an important source of modern biofuel, is a staple food for some of the population. In addition, maize is also an important source of feed and raw materials for many type of industries.

Since Indonesia has already determined to achieve and sustain food security, the effort to increase maize production mainly through increasing productivity has also challenged by two major sources of uncertainty, i.e. climate change and trade which require science and technology as well as market fairness and favorable policy.

In relation to our effort to enhance cooperation among some key stakeholders in food security issues and the need to spur up the regional coordination and networking, an International Maize Conference was held on 22-24 November 2012 in Gorontalo. The conference was organized by the Indonesian Ministry of Agriculture in collaboration with the Provincial Government of Gorontalo. The objectives of the conference were (i) to facilitate stakeholders in addressing the problems of the world maize production related to food security and alternative energy resources, and (ii) to share and exchange ideas/information of maize research results among scientists, researchers, policy makers, industries, and farmers from different countries in the world.

Attended by more than 400 participants from 10 countries, four main agenda of the conference were successfully organized. They were (i) International Seminar on Agribusiness of Maize, (ii) International Maize Expo, (iii) Governor Convention and Business Meeting, and (iv) Farm Field Day. The international seminar packed with exciting presentations and papers, all focussed on the theme of "Maize for Food, Feed, and Fuel". One keynote speaker from Indonesian Minister of Agriculture and some guest speakers from different countries came up with different perspectives of the theme.

I highly appreciate the participation and contribution of all participants and the organizer of the conference and my sincere gratitude to the Provincial Government of Gorontalo for all of the kind supports provided during the conference.

Jakarta, May 2013

Indonesian Agency for Agricultural
Research and Development
Director,

Dr. Haryono

ACKNOWLEDGEMENT

Indonesian Center for Food Crops Research and Development (ICFORD) would like to acknowledge and thank Prof. Dr. Sumarno, Dr. M. Machmud, and Mr. Mahyuddin Syam for reviewing the plenary session articles of the International Maize Conference 2012.

Extended acknowledgement is also addressed to International Maize and Wheat Research Institute (CIMMYT) and all sponsoring partners: Syngenta, Monsanto, BISI International, and DuPont Pioneer for their kind support during the conference.

CONTENTS

Foreword	iii
Contents	v
Keynote Speech Minister of Agriculture The Republic of Indonesia	x
Main Paper	1
Maize for Food, Feed and Fuel in Indonesia: Challenges and Opportunity	3
<i>Haryono</i>	
Indonesia Efforts Towards the Leading of Maize Agribusiness and Agroindustry in the World by 2025	10
<i>Fadel Mohammad</i>	
Maize in the Developing World: Trends, Challenges, and Opportunities	26
<i>BM Prasanna</i>	
Nutritionally Enhanced Maize and its Importance in the Developing Countries	39
<i>S.K. Vasal</i>	
Systems Modelling Approaches to the Sustainable Intensification of Agriculture	46
<i>Daniel Rodriguez</i>	
Indonesian Maize Production and Trading for Feed	53
<i>Desianto B. Utomo, Ph.D.</i>	
The Role of Biotechnology in Sustainable Agriculture	58
<i>Herry Kristanto</i>	
Technology's Perspective on Maize-based Agribusiness in Indonesia	61
<i>Benyamin Lakitan</i>	
Public-private Partnership on Maize Technology Development and Delivery: PT BISI International Experience and Overview	66
<i>Putu Darsana</i>	
Connecting Maize Farmers to the Markets: Creating Systemic Change	71
<i>Fahad Ifaz</i>	
Inheritance of Resistance Gene to Cucumber Mosaic Virus in Maize	76
<i>Budi Setiadi Daryono, Endang Mujiati, Diah Rachmawati, Sedyo Hartono and M.Yasin HG</i>	
Integrated Approach in the Management of Corn Cob Borers	83
<i>Anuradha, M., D.Srilatha, R.RangaReddy</i>	
Microsatellite-Based Markers Selection to Improve Hybrid Maize Breeding	86
<i>Marcia B. Pabendon, Sigit Budi Santoso and Nuning Argosubekti</i>	
Impact of Climate and Weather Variations on the Yield and Stability of Sweet Corn Under Semi-Arid Conditions	93
<i>Siva Lakshmi, D. Sree latha, V.Radha Krishna Murthy, T.Pradeep and K.M.Dakshina Murthy</i>	
Interactive Effects of Plant Population and Fertility Levels on the Productivity of Maize under Rice-Maize System	97
<i>D.Sreelatha, Y.Siva lakshmi, M.Anuradha and R. Ranga Reddy</i>	
Sustaining Maize Yield of the Cultivated Sloping Land by Terrace Farming	103
<i>J. Husain, Bahtiar, Nurdin, H. Kasim</i>	
Timor-Leste's Efforts to Achieve Maize Seed Security Using 'Community Seed Production'	106
<i>Buddhi Kunwar, Januario Marcal, Francisco Gama, Rui Amaral, Asep Setiawan and John Dalton</i>	

Phosphorus Requirement and Its Use Efficiency in Zero Tilled Maize After Kharif Rice	114
<i>A. Madhavi and P. Venkata Reddy</i>	
Effect of Organic and Inorganic Fertilizer Combinations on Yield, Dry Matter Production, and Crude Protein Content in of Stover and Cornhusk	118
<i>Dwi Retno Lukiwati</i>	
Poster Paper	121
Progress and Accomplishments of S M Sehgal Foundation in Hybrid-related Initiatives in Maize	123
<i>P Vani Sekhar, Mohamed A. N. Mostafa, Mallikarjuna N. and Murli D Gupta</i>	
Climate Change and Southern Rust (<i>Puccinia Polysora</i> Underw.) Infection on Corn Cultivars in Korea	128
<i>Claudino Ninas Nabais, Soon-Kwon Kim, Nwe Win Win, Dhami Narayanan Bahadul, Abu Hendri Saputra, Mohammad Afhzal Sarwari, Tungalag Munkhbat, Don Ho, and Moon Ka Hee</i>	
Government Policy, Maize Production and Food Shortage in East Nusa Tenggara, Indonesia	139
<i>Yohanis Ngongo, Ignas K. Lidjang, Charles Y. Bora, and Rob Cramb</i>	
Maize: The Food, Feed, and Fuel	146
<i>Samanhudi and Bambang Pujiasmanto</i>	
Application of Technology in Farming and Corn Waste at South Sulawesi	152
<i>Sunanto, Eka Triana Yuniarsih, and M. Asaad</i>	
Increasing Corn Productivity with Application Cashew Skin as an Organic Fertilizer in Muna Regency South East Sulawesi	158
<i>Asmin and Zainal Abidin</i>	
The Analize of Inovation Technology Implementation of Hybrid Corn in Alebo Southeast Sulawesi	161
<i>Suharno, Rusdin and Muh. Taufiq Ratule</i>	
Maize Farming Analysis and Determinant Factors of Maize Price in the Upland of Timor Island, East Nusa Tenggara	167
<i>Helena da Silva and Bambang Murdolelono</i>	
Corn Hominy, a Potential Material for Biodegradable Foam	172
<i>E. S. Iriani, T.T. Irawadi, T.C. Sunarti, N. Richana, and I. Yuliasih</i>	
Characterization of Eight Maize Varieties With a Low Glycemic Index to Support Food Security	178
<i>Nur Richana, Ratnaningsih, Abdullah Bin Arif, and Maulida Hayuningtyas</i>	
Improving Index Pattern in Low Land Rice with Corn in Konawe Southeast Sulawesi	184
<i>Zainal Abidin, Idris, and Muhammad Rusman</i>	
Seed Genetic Purity Assessment of Hybrid Maize Using Microsatellite Markers (SSR)	188
<i>Awaludin Hipi, Memen Surahman, Satriyas Ilyas, and Giyanto</i>	
Farmers' Perceptions to the Maize Integrated Crop Management in Dryland Agro-Ecosystem of Timor Island ..	193
<i>B. Murdolelono, Helena Da Silva, and E. Budisantoso</i>	
Growth Characteristics of Three Cultivars Maize Plants in Symbiosis with Arbuscular Mycorrhiza Fungi	199
<i>Novri Youla Kandowangko and Yuliana Retnowati</i>	
Soil Chemistry and Yield of Maize as Influenced by Different Levels of Fertilizer in Ex-Tin Land Central Bangka, Kepulauan Bangka Belitung	205
<i>Asmarhansyah, D. Rusmawan, and Muzammil</i>	
Influence of Fertilizing and Variety on Growth and Yield of Maize in Ex-Tin Land Central Bangka, Kepulauan Bangka Belitung	209
<i>D. Rusmawan, Muzammil, D.Y. Rinawati, and Asmarhansyah</i>	
The Sorghum Serealia Functional Foods Utilization to Prevent Cancer in Foods Diversification Efforts	214
<i>Yuzda K. Salimi</i>	

Spatial Spread of Land Support Capability of Agriculture System in Pohuwato District Gorontalo Province Indonesia	218
<i>Fitris S. Bagu</i>	
Consumer's Preference of Corn Pudding Formulated with Corn Flour and Carragenan	224
<i>Lisna Ahmad and Muh. Tahir</i>	
Land Suitability and Farmer Perception on Maize Cultivation in Limboto Basin Gorontalo	229
<i>Bahtiar, J. Husain, H. Kasim, and Nurdin</i>	
Potential of Hybrid Maize Varieties for Feed and Food on Irrigated Land in Supporting Cattle Development and Food Diversification	235
<i>Baiq Tri Ratna Erawati, Ahmad Suriadi, and Andi Takdir</i>	
Potential Predator and Parasitoid Local to Pests Control of Maize Stem Borer in Gorontalo Province	239
<i>Witjaksono, Muh. Asaad, Nugroho Susetya Putra, and Mohamad Lihawa</i>	
The Impact of Cropping Intensity on Maize Marketing in Rainfed Area	242
<i>Margaretha S. Lulu, Muh. Azrai, and M. Aqil</i>	
Seed Yield and Quality of Three-Way Cross Hybrid Maize Production in South and Central Sulawesi of Indonesia	247
<i>Ramlah Arief, M. Azrai, and Sigit Budi Santoso</i>	
The Effect of Seed Immersion Duration on Membrane Leakage and Maize Seed Vigor (<i>Zea Mays L.</i>)	252
<i>Oom Komalasari and Ramlah Arief</i>	
Conditioning Effects on Physiological and Biochemical Characteristics of Maize Seed (<i>Zea mays L.</i>)	256
<i>Fauziah Koes, Ramlah Arief, and Sigit Budi Santoso</i>	
Effect of Potassium on the Growth, Production and Quality of F1 Hybrid Maize	261
<i>F. Tabri and M. Akil</i>	
Identification of Super And Ultra Early Maturity Maize Lines Resistance Against Leaf Blight Disease (<i>Bipolaris Maydis</i>)	264
<i>Soenartiningih, R. Neni Iriany, dan Andi Takdir M.</i>	
Evaluation of Resistance of super and Ultra Early Maturity Maize to Downy Mildew (<i>Peronosclerospora spp</i>)	269
<i>Andi Takdir M. and Soenartiningih</i>	
Evaluation of Maize Production Technology Component to Increase Farmer's Income in Rainfed Low Land	273
<i>Syuryawati, Roy Efendi, and Faesal</i>	
Economic Analysis of Hybrid Maize in South Sulawesi	278
<i>Hadijah, AD. and Herman Subagio</i>	
Early Maturity and Acid Soils Tolerance Maize Lines Performance In West Sulawesi Indonesia	382
<i>Faesal</i>	
Planting System and Mulch Related to Growth And Results Corn in the of Land Slope of Riau Province	387
<i>Yunizar</i>	
Participants	291



MINISTRY OF AGRICULTURE
REPUBLIC OF INDONESIA

Keynote Speech Minister of Agriculture The Republic of Indonesia

**At The Opening Ceremony of International Maize Conference
“Maize For Food, Feed and Fuel”
Gorontalo, 22-24 November 2012**

Distinguished guests,

- **Dr. Prasanna Boddupalli, Director, Global Maize Program, CIMMYT, Nairobi, Kenya**
- **Governor of provinces in Sulawesi**
- **Participants, Ladies and Gentlemen.**

Assalamu'alaikum warahmatullaahi wabarakaatuh,

It is a great pleasure to be here and warmly welcome you all to this important gathering at the International Maize Conference, pertaining to the topic of **“Maize For Food, Feed And Fuel”**

The significance as well as the relevancy of this topic is particularly emphasized by the problem of the shifting balance between crops for food versus feed and fuel. Statistics show that for every 10 ears of corn that are grown in the United States today, only 2 are consumed directly by humans as food. The remaining 8 are used in almost equal shares for animal feed and for ethanol. This shift in balance between food and fuel may as well be the tipping point in world grain markets. China, once able to supply its internal corn demand, currently expects to import a few million tons of corn next year. This will likely place additional stress on maize market and industry.

I believe through this seminar, all participants will take the problems of this situation into account, coming up with new progressive ideas on the use of advanced technology and policies, to serve as an incentive in enhancing the maize production, in hopes of coping with future challenges.

Ladies and Gentlemen,

In 2050 the world's population will rise from 6 billion to 8 billion (33 percent) and half of them are in Asia. Consequently, the demand for food will increase by 50 percent, while the demand for water and energy will increase by 30 and 50 percent, respectively. Urbanization will continue at an accelerated pace, and about 70

percent of the world's population will be urban. Income levels will multiply. In order to feed this larger, more urban and richer population, who most likely would consume more protein, meat production and feed must subsequently be increased.

Maize is an important food crop that serves as a source of food, feed, fuel and raw material for many industries. In the five years strategic plan 2010-2014 Ministry of Agriculture Republic of Indonesia targeted to maintain self-sufficiency in domestic maize production. Therefore, maize production should be increased by 10.2 percent annually from 17.66 million ton in 2009, to 29.0 million ton by 2014. Through the cooperation of government agencies private sectors, and farmers, domestic maize production in 2012 had increased by 1.3 million (7.5 percent) from the production in 2011; therefore, we can safely assume that the aforementioned target of maintaining self-sufficiency has been executed.

One of our concerns in maintaining said self-sufficiency is how we increase our productivity level. Keeping that effort in mind, our government formulated some programs that included improving the irrigation system, creating new agricultural lands (especially sub-optimal lands), the utilization of high-yielding new varieties, and the implementation of technology for plant cultivation.

Ladies and Gentlemen,

The challenge we face to increase maize production may lie in future unpredictable situations. Chief among these are climate change and trade. Several recent efforts have been made to further forecast the possible impacts of climate change in agriculture.

These predictions remain highly uncertain, but scenarios are beginning to come together to form a fuller picture. Higher temperature and drought could serve as problems to reduce global agricultural product yields. Indeed, climate change is admittedly already taking place, no longer it is a prediction.

An additional adumbrate pertaining to the future role of agricultural product trade is necessary partly because of high trade restrictions. Coupled with an erratic government interventions, such as the 2008 export bans, this had resulted in relatively unstable grain prices. Global energy crisis in recent years has triggered equally-global food problems. The high price of fuel gave the incentive to convert some food commodities to bio-fuel, leading to a shortage in the world's food supply, and a subsequent soaring of world food prices. Ergo, climate change as well as volatile energy prices may serve to further impinge food product prices. Indonesia's policy, prohibits the converting of food crops, such as maize, into bio-energy source. Another serious challenge is the frequent natural disasters that occur in Indonesia.

To meet such challenges, there are two matters that we should take into consideration. First, we must enhance regional and global coordination and cooperation. Second, we have to ensure the maintenance of order and condition in the region favorable for the achievement of our development objective.

Ladies and Gentlemen,

Since no man is an island, it is of utmost importance that we work together in implementing the various programs and actions as a collaboration between Government to Government, IARC-Government-NGO, Industries, Education, Media, to increased food production through the increase of productivity.

Alongside China, India, and Brazil, Indonesia as one of the largest tropical countries is expected to contribute to global food security and play a greater role on international level to feed the world. I sincerely hope that this conference facilitates the participants fresh idea in discussing the challenges of how to balance maize for food, feed and fuel. I would like to propose more coordination of policies regarding price, stocks, export and import, as this will have a significant impact on poverty. I feel Indonesia could learn from other countries' experiences, such as from India, Australia, Mexico, Nigeria, and others.

Ladies and Gentlemen,

I really hope that this conference will result in possible recommendations for the government and others as well on how to meet present and future challenges .

Finally, with **Bismillahirrahmanirrohim, I declare International Maize Conference pertaining to “MAIZE FOR FOOD, FEED AND FUEL” open.** I wish you all have a productive meetings and stimulating discussion, and a pleasant stay in Gorontalo.

Wassalaamu'alaikum warahmatullaahi wabarakaatuh.

Minister of Agriculture,

SUSWONO

Potential Predator and Parasitoid Local to Pests Control of Maize Stem Borer in Gorontalo Province

Witjaksono¹, Muh. Asaad², Nugroho Susetya Putra¹, and Mohammad Lihawa³

¹Faculty of Agriculture, Gadjah Mada University

²Gorontalo Assessment Institute for Agricultural Technology

³Student on Faculty of Agriculture, Gadjah Mada University

ABSTRACT. Corn borer is one of the important pests on corn in Gorontalo province. Studies on natural enemies (parasitoids and predators) of this pest in Gorontalo province has not been much studied. For the study of the potential of local natural enemies need to be done. The purpose of this study is to see what kind of diversity, composition, level parasitism, and predation. Data collection using the survey method in three districts in Gorontalo Province and data were analyzed using the Shannon index. The results obtained for the type of local parasitoids were found to consist of the order Diptera, Tachinidae family, order Hymenoptera, Chalcididae family, and the tails in Boalemo districts and 89 tails parasitoid in Pohuwato district. Furthermore parasitism rate of 53.3 % is higher than the level of predation that is only 3.3%. One factor that supports the abundance of natural enemies is the existing vegetation surrounding the corn crop.

Keywords: corn borer, natural enemies

Introduction

Corn is one of the agricultural commodities are expected to tackle the food crisis, and will support national food security by placing corn as a second crop after rice. Corn is a source of food, feed and industrial raw materials.

In an effort to improve corn production in the province of Gorontalo, it should be noted the presence of pests and diseases that can affect the production of corn. One of the pests that often and quite important is corn borer *Ostrinia furnacalis* Guenee (*O. furnacalis* Guenee), and the pink stem borer *Sesamia inferens* (*S. inferens*).

O. furnacalis are common in Southeast Asia, Central Asia, East Asia, and Australia. In China area these pests are major pest on corn and other crops (Zhou *et al.* 2005). In Indonesia *O. furnacalis* is one of the major pests in cropping maize (Nonci 2004). In addition to pest Gorontalo *O. furnacalis* also found the pink stem borer *Sesamia inferens* (Lihawa *et al.* 2010). In 2003, widespread stem borer pests of corn in the province of Gorontalo reached 1085 ha and 10 hapuso (Herman 2007). Moreover due to stem borer attack has caused physical damage, nutrient disorders and affects the movement of water and nutrients in the plant (Anonymous 2006; Capinera 2008; Sandra *et al.* 2010).

Based on the above conditions, the study of local predators and parasitoids as potential biological control agent of maize stem borer needs to be done, it would be

safe for the environment, human and crop production (corn). Biological control by used of predators and parasitoids is one of the cultivation technology that environmentally friendly, especially to support export-oriented "zero pesticide".

Materials and Methods

The method used is a survey method, that is to see the diversity, composition and abundance of predators and parasitoids stem borer in three districts (Gorontalo, Boalemo and Pohuwato) in 2011. Observation plots in each district area of 2,500 m², divided into three sub-plot size of 3 m x 3 m and several plants each plot about 45 plants with corn plant spacing of 75 cm x 25 cm.

Exploration/collection of natural enemies and corn borer (eggs, larvae, and pupae) in each plot 3 m x 3 m area of 9 m², identification of natural enemies (predators and parasitoids), for the potential parasitism collected 30 corn borer from each plot.

Data were analyzed by descriptive and organized into tables, to the diversity and composition using the Shannon Index (Wratten and Fry 1980),

$$H = - \sum \frac{N_i}{N} \log \frac{N_i}{N}$$

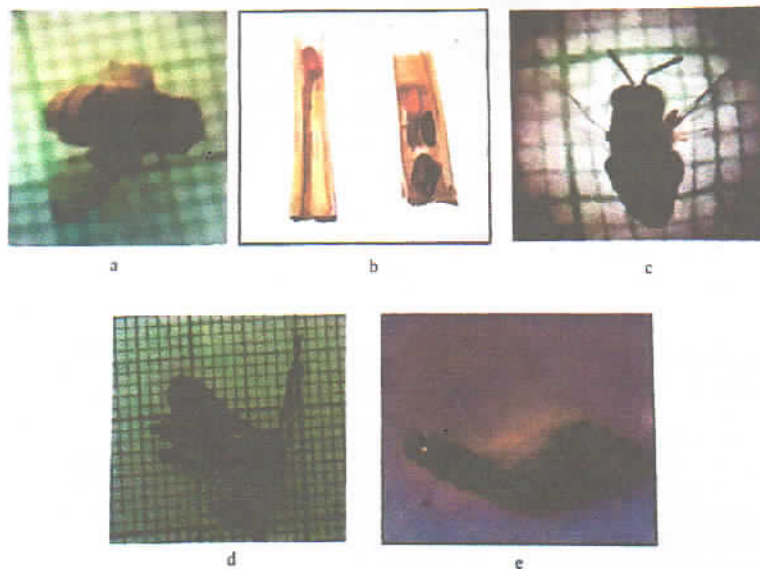
Results and Discussion

The results of the exploration of natural enemies of maize crop in three locations in the district (Gorontalo, Boalemo, and Pohuwato), obtained from the predatory natural enemies, namely the Order Coleoptera, Family Coecmelidae, Staphylinidae, Carabidae; Order Araneae, Family Lycosidae, Salticidae, Tetragnatidae, and order Dermaptera with every small population. Also in corn planting can also be found predators such as *H. octomaculata*, *Micraspis* sp., *M. sexmaculatus*, *M. crocea*, *Crysopa* sp., and *Orius* sp., that could potentially suppress populations of *O. furnacalis* (Nonci 2004; Koch *et al.* 2006). But the natural enemies of the parasitoids were found are of the order Diptera, Tachinidae family, order Hymenoptera, Ichneumonidae family and Chalcididae.

Furthermore Dutton (2003) and Losey (2004), reported that in Western Europe one parasitoid potentially regulate and control the maize stem borer *O. nubilalis* parasitoid *Erioborus terebrans*. Parasitoid was included in the Order Hymenoptera Family Ichneumonidae. Parasitoids attacking larvae *Erioborus terebrans* *O. nubilalis* that are in non-transgenic corn plants.

The composition of the population of natural enemies (predators and parasitoids) shows that for Gorontalo regency is the most natural enemies of the predator are 52 individuals, while the parasitoid are three individuals. Pohuwato district was and is the most natural enemies of the parasitoid, respectively for Boalemo district some 70 individuals, Pohuwato 89 individuals, while the predator to the district Boalemo about 43 individuals, and 57 individuals in Pohuwato.

Many parasitoids obtained are of the order Diptera, Tachinidae family, last instar parasitoid larvae and pupae corn borer, rate of about 50% parasitism Boalemo district, and the district Pohuwato parasitism level around 53%, while in the Gorontalo regency Tachinidae parasitoids are not found. Corn borer parasitoids found in Gorontalo regency was of the order Hymenoptera family Ichneumonidae parasitism rate 6.7%, and the family Chalcididae parasitism rate of around 3.3%. While the predatoris found was of the order Araneae and Dermaptera the predation rate is about 3.3%. For detail sthe following picture (Figure 1) the local parasitoid and its parasitism level (Figure 2).



Description:

- a) last instar parasitoid larvae and pupae Maize Stem Borer found in the district. Boalemo and districts. Pohuwato (order Diptera; family Tachinidae)
- b) Pupa Tachinidae
- c) and (d) Maize stem borer parasitoids (Hymenoptera order, Family Chalcididae and family Ichneumonidae) found in Gorontalo regency
- e) *Ostrinia furnacalis* larvae are parasitized by Ichneumonidae

Figure 1. Maize stem borer local parasitoids were found in Gorontalo

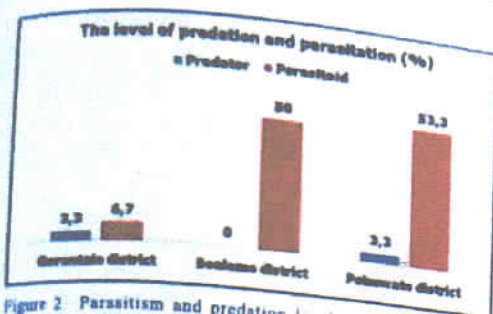


Figure 2. Parasitism and predation levels % of local natural enemies in Gorontalo

Based on this, the parasitoid of the order Diptera, Tachinidae family more potential to reduce several population of *O. furnacalis* in the next planting season, and is quite effective for along time, but for the parasitoid eggs have not been found.

Furthermore, the diversity of natural enemies in Gorontalo regency and district Boalemo including category, it can be seen from many individuals found only about (55-115) individuals. While the district Pohuwato diversity of natural enemies were high, as the number of individuals found that a lot more about (143) individuals. The diversity of natural enemies in three research illustrates many species/individuals from natural enemies found. The abundance of natural enemies in the district Pohuwato could be supported by the existing vegetation surrounding the corn crop.

Acknowledgements

Conveyed to the Agency for Agricultural Research, organizations devoted to the Gadjah Mada University, Basic Entomology Laboratory Faculty of Agriculture Gadjah Mada University, Institute for Agricultural Technology Gorontalo, Integrated Laboratory Faculty of Agriculture Gorontalo University, Farmers Group in the province of Gorontalo, and Santy Fuji Pomalingo for their participation to this study.

References

- Anonim. 2006. Field guide to non-chemical pest management. In Corn Production. Pesticide Action Network (PAN) Germany Email info@pan-germany.org Prepared by: Dr. Jewel Bissdorf Editor Carina Weber Layout: Reginald Bruhn 44p.
- Capinera, J.L. 2008. Maize (corn) pests and their management. Encyclopedia of Entomology. Springer Science + Business Media B.V. University of Florida, Gainesville, FL, USA.
- Dutton, A., Jorg Romeis, and Franz Bigler. 2003. Assessing the risks of insect resistant transgenic plants on entomophagous arthropods: bt-mayze expressing cry 1 ab as a case study. *Bio Control* 48: 611-636.
- Herman, M. 2007. Sebelas tahun perkembangan jagung bt dan statusnya secara global. balai besar penelitian dan pengembangan bioteknologi dan sumberdaya genetik pertanian. Jl. Tentara Pelajar 3A, Bogor 16111. *J. Agro Biogen*.
- Koch, R.L., E.C. Burkness, and W.D. Hutchison. 2006. Spatial distribution and fixed-precision sampling plans for ladybird *Harmonia axyridis* In Sweet Corn. Departement of Entomology, University of Minnesota, 219 Hodson Hall, 1980 Folwell Avenue, St. Paul, Minnesota, 55108, USA. *Biocontrol* (2006) 51:741-751.
- Lihawa, M., Witjaksono, and Nugroho Susetyo Putra. 2010. Identifikasi penggerak batang jagung di Provinsi Gorontalo. Makalah disampaikan pada Kongres Entomologi Indonesia, di Yogyakarta UGM, pada tanggal 1-2 Oktober 2010.
- Losey, J. E., J. J. Obrycky, and R. A. Hufbauer. 2004. Biosafety considerations of transgenic insecticidal plants: non-target predators and parasitoids. *Encyclopedia of Plant and Crop Science*. 156-159.
- Nonci, N. 2004. Biologi dan musuh alami penggerak batang *ostrinia furnacalis guenee* (lepidoptera: pyralidae) pada tanaman jagung. *Litbang Pertanian*. 8-14.
- Sandra, F. Y., Joann K. W., Bao-Luo Ma, and Yves Gelinat. 2010. European corn borer injury effects on lignin, carbon and nitrogen in corn tissues. *Plant Soil*. Springer Science. Business Media B.V. 13p.
- Wratten, S.D. and Fry, G.L.A. 1980. Field and laboratory exercise in ecology. Thompson Litho Ltd., West Killbride, Scotland.
- Zhou, H., Jiawei DU, and Yongping Huang. 2005. Effects of sublethal doses of malathion on responses to sex pheromones by male asian corn borer moths, *Ostrinia furnacalis* (Guene' E). *J. Of Chemical Ecology*, Vol. 31, No. 7, 1645-1656.



SCIENCE. INNOVATION. NETWORKS

www.litbang.deptan.go.id



ISBN 978-979-1159-59-3